Evolutionary Psychology

This paper addresses a fundamental limitation that restricts most attempts to apply the findings of evolutionary psychology to the human condition. Most attempts focus on how our biological past constrains and limits our behavioural options (including our cognitive abilities). They generally fail to look at whether these constraints can be overcome in our future evolution. To date, evolutionary psychology has not satisfactorily addressed a key question: are we beings that are forever constrained by our biological past, or can we acquire new psychological software that will enable us to become self-evolving organisms - beings that are able to adapt in whatever ways are necessary for future evolutionary success, largely unfettered by our biological and social past? This paper is directed squarely at answering this issue.

The answer to this issue is highly relevant to the nature/nurture debate. This debate will eventually dissolve if humans are capable of acquiring psychological skills that enable them to modify and overcome both their genetic and cultural behavioural predispositions. For individuals who acquire these skills, neither nature nor nurture will control their behaviour and cognition.

In my view, a comprehensive approach to psychological evolution will not be restricted to examining only our biological past. It cannot ignore the fact that we are evolutionary work-in-progress. It must also look at our present and future psychological evolution. Only when it does so will evolutionary psychology fully qualify as scientific by being predictive in the widest sense.

The paper builds on a number of the ideas on psychological evolution presented in Chapters 8 to 12 inclusive of my book "Evolution's Arrow" which is at http://www4.tpg.com.au/users/jes999/

FUTURE PSYCHOLOGICAL EVOLUTION

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ABSTRACT: Humans are able to construct mental representations and models of possible interactions with their environment. They can use these mental models to identify actions that will enable them to achieve their adaptive goals. But humans do not use this capacity to identify and implement the actions that would contribute most to the evolutionary success of humanity. In general, humans do not find motivation or satisfaction in doing so, no matter how effective the actions might be in evolutionary terms. From an evolutionary perspective, this is a significant limitation in the psychological adaptability of humans. This paper sets out to identify the new psychological capacity that would be needed to overcome this limitation and how the new capacity might be acquired.

1. INTRODUCTION

Is the psychological evolution of humanity at an endpoint? Or are there limitations and deficiencies in our psychological capacities that could drive further evolution? Are there, for example, new forms of psychological software that humans could acquire to improve our ability to adapt to whatever challenges face us in the future?

One way we can begin to answer this question is to ask whether there are blind spots in our current psychological capacities. Are our existing abilities to discover and implement useful adaptive behaviours seriously limited? Are we unable to explore areas of the space of adaptive possibilities?

If we discover that there are limitations in our current psychological capacities, we can then ask whether these can be overcome by changes to our psychological software. Can our psychological adaptability be improved by, for example, the acquisition of new psychological skills and capacities? Can these be developed through learning and appropriate experiences?

If we find that there are limitations, and if these can only be overcome by changes to our psychological software, we can then ask whether humans are likely to make these changes. Will we do what is required to develop the software? Will we be motivated to make whatever effort is necessary to evolve our psychology? Or are humans caught in an evolutionary predicament—are we unable to make these psychological improvements because of the limitations in our psychological adaptability?

We begin in section 2 by identifying significant limitations in our current psychological capacities. Section 3 of the paper examines how these could be overcome by the acquisition of new psychological abilities, and section 4 assesses the likelihood that humans will develop these capacities.

2. CURRENT PSYCHOLOGICAL LIMITATIONS

What are the strengths and weaknesses of our current psychological adaptive capacities?

Our main strength compared with other organisms is our ability to use mental models to discover and implement useful adaptations (see, for example, Popper, 1972 and Dennett, 1995). Instead of having to try out alternative actions in practice, humans can use mental models to predict the effects of the alternatives. Using representations of ourselves and of our environment, we can try out possible adaptations mentally. This significantly reduces the need for costly trial and error, and enables us to take account of the (predicted) future consequences of our actions.

Our ability to test alternative behaviours mentally is the basis of our capacity to plan ahead, imagine alternatives, invent and adapt technology, build structures such as houses and roads, radically modify our external environment for our adaptive goals, establish long-term objectives, imagine how we might change the world, develop strategic plans, design projects and undertake activities that pay off only in the future, such as plant crops and feed animals.

The acquisition of language greatly enhanced our capacity for mental modelling. Language and associated forms of communication enabled humans to share the knowledge that is used to construct useful models of reality. All members of a society could eventually acquire and use the

knowledge discovered by any individual. This enabled knowledge to be accumulated across the generations. The progressive accumulation of knowledge has enabled humans to model more accurately a greater range of interactions with our environment, and to predict the consequences of our actions over wider scales of space and time (Stewart, 1995). This has enabled us to discover more effective ways of achieving our adaptive goals.

Our ability to construct and manipulate models has also improved as we have learnt to augment our mental abilities with external artefacts such as pen and paper, books, recording devices, computers and other forms of artificial intelligence.

Our mental adaptability can be expected to continue to improve as humanity accumulates more knowledge about how the external world responds to our interventions and as artificial intelligence is developed further.

In principle, we could use mental modelling to greatly enhance our evolutionary adaptability. We could use mental modelling to discover and implement adaptations that are best for humanity in evolutionary terms. We could do this by using modelling to identify the future consequences of alternative actions, including their evolutionary effects. This would enable us to determine which actions would contribute best to the evolutionary success of humanity. We would be as effective at discovering the best adaptations as our models allowed. As our modelling capacity improved, humanity would be able to adapt successfully to a wider range of evolutionary challenges.

The use of mental modelling for evolutionary adaptation would easily outperform gene-based natural selection. Genetic evolution is largely blind and operates by trial and error. It has no capacity to predict the future effects of alternative adaptations and to use these predictions to identify the best adaptation. Furthermore, genetic evolution cannot learn and accumulate knowledge throughout the life of the individual. And it is unable to establish adaptations that benefit only future generations and not the organism itself [and its genes] (see for example, Stewart, 1997a). Once a species has accumulated sufficient knowledge, the use of mental modelling for evolutionary adaptation would enable it to adapt to a much wider range of events than a similar species that evolves genetically.

However we do not use our mental modelling in this way. We do not use it to discover and implement the adaptations that will deliver evolutionary success to humanity. Most humans are unconcerned about the evolutionary consequences of their actions. Instead we use the enormous power of mental modelling to see how we can act on the world to produce desirable psychological states and avoid unpleasant ones. For most this means using modelling to pursue sex, wealth, satisfying relationships, social status, fame and so on.

An evolutionary perspective helps explain this state of affairs. As we have seen, evolution would favour species that use mental modelling for evolutionary adaptation. Once such a species emerged, it would flourish. But evolution was not able to produce this capacity immediately in the evolution of life on Earth. A brain that is capable of mental modelling took a very long time to evolve by the blind trial-and-error of genetic evolution.

Until mental modelling evolved, gene-based natural selection had to find simpler arrangements to adapt organisms during their life. The simplest way to achieve this was to fit out the organism with arrangements that discovered adaptations by trial and error. These arrangements would make changes in the organism until a change is made that is found to be adaptive in evolutionary terms. But what arrangements within the organism could ‘know’ whether a particular change is

adaptive? The answer is easy to see when the event to which the organism must adapt disrupts the effective functioning of the organism—changes can be tested on the basis of their ability to restore effective functioning (Ashby, 1960). For example, an organism trying to outrun a predator might deplete the oxygen in its leg muscles below the level needed for peak performance. Increases in the organism's heart rate could be tried out until oxygen levels are restored and the leg muscles are able to perform effectively again. But this method will not work when an adaptive change produces only future benefits to the organism, and does not produce any immediate improvement within the organism (Beer, 1972). Examples include actions that organize sexual reproduction, and much of the behaviour that protects social status within a group. Neither of these generates any immediate benefits to the organism that could be used as indicators of the usefulness of the behaviour.

How could gene-based natural selection organise an organism so that changes that produce no immediate benefit to the organism, but produce evolutionary benefits in the longer term, would be selected as adaptations? How could possible adaptations be tested within the organism to identify those that produced benefits only in the longer term? The simplest way is to test them against proxies for future evolutionary success. Natural selection could fit out organisms with a system of internal goals and rewards whose satisfaction is correlated with evolutionary success. Possible adaptations would be tested within the organism against their ability to achieve the internal goals or rewards (Frank, 1988. See also Stewart, 1997b).

Such an organism would spend its life pursuing these internal rewards and goals. This would be experienced by the organism as responding to motivations and to emotional states and impulses. The genetic evolutionary mechanism would tune these so that when the organism pursued its internal rewards, it would act in a way consistent with evolutionary success. For example, actions that organise sexual reproduction could be rewarded with pleasurable feelings, and behaviour that could destroy an individual's reputation within its social group could be deterred by unpleasant feelings of guilt.

Until they acquire a capacity for mental modelling, organisms have to be organised in this way to pursue proxies for evolutionary success. But even when mental modelling finally emerges, organisms would still have to be organised to pursue the goals established by their internal reward system. This is because mental modelling will be grafted on to an organism whose adaptation is already organised by an internal motivation and reward system. Gene-based natural selection can only build on whatever is already available. Furthermore, mental modelling will not have the capability to immediately take over the adaptation of the organism. The organisms would not have accumulated the detailed knowledge and information needed for their models to be able to predict the future consequences of a wide range of alternative actions—modelling will be less effective than the pre-existing motivation and reward systems at discovering the best adaptations (Stewart, 2000).

But mental modelling will still provide immediate advantages. It enables the organism to find better ways of achieving its internal rewards and motivations. The organism can use mental models to identify the behaviours that will be best at achieving outcomes that produce desirable internal states. Initially mental modelling will not establish the adaptive goals of the organism—it begins as a servant of the pre-existing motivation and reward systems.

However, clashes and contradictions will begin to emerge as the superior adaptive potential of mental modelling begins to be realised (Stewart, 2000). As the organisms accumulate knowledge they will be able to predict the consequences of alternative behaviours more accurately and

further into the future. The modelling capacity will begin to suggest different adaptations to those supported by the pre-existing internal reward system. The superior adaptive ability of mental modelling will enable the organism to see that particular behaviours are in its interests, but the behaviours are not motivated or rewarded by its pre-existing systems. In some circumstances, its pre-existing systems may strongly motivate behaviours that the organism now sees are against its interests. Increasingly as knowledge accumulates, what the organism wants to do (as motivated by its pre-existing systems) will clash with what it sees mentally is in its interests, particularly in the longer term.

Eventually the organisms are likely to accumulate sufficient knowledge to model and understand the evolutionary processes that have produced them. They will begin to understand that the clashes they are experiencing between their adaptive systems are symptoms of their participation in a major evolutionary transition. They will see that they are located in a sequence that has the potential to move from an organism that is organised by evolution to pursue proxies for evolutionary success, to an organism that uses mental modelling to consciously identify and implement whatever actions will contribute most to the evolutionary success of the species.

It is possible to locate humanity within this sequence. As we have already noted, humans are not yet an organism that uses mental modelling to adapt in whatever ways are needed for evolutionary success. We are not motivated to do so—the evolutionary consequences of our actions are largely irrelevant to us. Instead we use our mental modelling to work out how to achieve the goals set by our internal reward and motivation system—goals that humans have been fitted out with by natural selection and that are modified to a limited extent by conditioning during their upbringing.

We spend our lives pursuing desirable psychological states such as those associated with popularity, self-esteem, sex, feelings of uniqueness, power, food, and social status, and we try to avoid undesirable psychological states such as those associated with stress, guilt, depression, loneliness, hunger, and shame. It is of little or no concern to us whether these proxies for evolutionary success in fact encourage behaviour that will bring evolutionary success. When our evolutionary interests clash with our motivations and emotional responses, our evolutionary interests lose out. In this way, our motivation and reward system severely constrains how we are able to adapt and what we can choose to do.

But humans are increasingly encountering situations where our mental models suggest different adaptations to those motivated by our pre-existing internal reward systems. Our mental models are becoming sophisticated enough to out-perform our internal reward system in many situations. For example, many find that we are motivated to eat larger quantities of high-fat food than we know is in our longer–term health interests. Many find that rather than do the study that we see is needed to enhance our career prospects, we are more strongly motivated to spend our time doing other things. We cannot easily change personality traits and habits that we see are against our interests. Few of us can effortlessly ‘turn the other cheek’ even when we can see mentally that it is in our interests to do so. We find it very hard to do things we are not motivated to do.

However, humanity in general has not yet developed a comprehensive capacity to resolve these conflicts. When we see that our motivations and emotional responses are causing us to behave contrary to our interests, we cannot just change our motivations or override them. In general, humans have a very limited ability to consciously change their motivations and emotional responses to align them with the findings of their mental models. Increasingly humans are discovering that although a particular course of action provides immediate emotional rewards, it

is not in their longer-term interests. However, the fact that we can see this does not automatically empower us to change the way we will respond emotionally, or enable us to choose to be more highly motivated to pursue our longer-term interests. Humans have no comprehensive capacity to align their internal reward and motivation system with whatever goals they may set using their mental models (Stewart, 2000).

If we could align our motivations with our mental goals, it would mean that once we used our mental modelling to identify a long-term goal, we would be able to find motivation and satisfaction in whatever we had to do to pursue the goal. Behaviour that was normally highly motivated and rewarding would no longer be so if we saw that it conflicted with our central goal. We would be able to effortlessly defer immediate gratification whenever it was in our longer-term interests to do so. We would be able to change the emotional responses and motivations that entrench any personality traits and cognitive patterns that stand in the way of achieving our goals.

Far from being able to consciously change our likes, dislikes, motivations and emotional responses, we are barely aware of them and their effects on our behaviour. We tend to look out the world and see how we can change it to achieve desired emotional states, rather than look inwardly and see how we can change our emotional states. We tend to take our emotional responses and motivations as fixed and given, rather than as things we can control consciously (Stewart, 1997b). Instead of seeing our motivations, values, likes, dislikes and personality traits as limiting our adaptability, we see them as defining who we are.

The burgeoning self-help and human potential literature is evidence that humans are experiencing these conflicts, and that we do not yet have a comprehensive ability to resolve them in our interests. This is underlined by the findings of a comprehensive survey of self-help literature undertaken by Covey (1989): much of the literature is directed at techniques to enable individuals to reduce the power of motivations and emotional responses that clash with their longer-term interests (e.g. techniques for deferring immediate gratification), and is directed at techniques to enable individuals to find satisfaction and motivation in the pursuit of longer-term objectives. He also found that many religious practices (hymns, mediation, prayer etc) serve these functions.

In summary, humans do not have the ability to align their internal reward and motivation system with goals of their choosing. They are unable to choose to find satisfaction and motivation in whatever adaptations will serve these goals. If humans had such a capacity, they could choose to implement whatever actions would advance the evolutionary success of humanity, and they would find satisfaction and motivation in this. Without such a capacity, we are not able to implement many adaptations that are in the evolutionary interests of humanity. We continue to spend our lives pursuing internal rewards and motivations established by our evolutionary and social past, even though we now are equipped with a capacity for mental modelling that is increasingly superior in adaptive terms. The immensely powerful technologies humanity is developing such as genetic engineering and artificial intelligence are being harnessed to serve our internal reward and motivation systems, not to advance our evolutionary potential.

For these reasons, our psychological adaptability is fundamentally limited in evolutionary terms. Adaptations exist that are superior in evolutionary terms, we can see that they are superior, but we do not implement them. Our motivations and emotional responses severely constrain what we can do. Because of this psychological limitation, humanity is not yet able to take advantage of the superior ability of mental modelling to discover and implement the most effective

adaptations. We can see that it is potentially far superior to gene-based natural selection, but are unable to exploit this potential.

3. CAN THESE PSYCHOLOGICAL LIMITATIONS BE OVERCOME?

Can humanity overcome its current psychological limitations? Rather than continue to pursue only internal proxies for evolutionary success, can humanity develop the capacity to use mental models to identify and implement whatever adaptations are best in evolutionary terms? Can we, for example, develop new psychological software that will enable us to align our internal rewards and motivations with whatever actions are identified by our mental modelling as being in our evolutionary interests?

The theory of metasystem transitions developed by Turchin (1977) points to the type of psychological reorganisation that might overcome these limitations. Turchin's theory deals in large part with the evolution of new adaptive capabilities in organisms. He suggests that these typically emerge when a new level of control arises that manages a collection of pre-existing adaptive processes. The new level of control might, for example, manage the pre-existing processes so that they henceforth serve a new adaptive objective. The new controller would align the goals and operation of the pre-existing processes with the new adaptive requirement. The result would be a new metasystem S' in which sub systems S_i (the pre-existing adaptive processes) are integrated by a new mechanism 'C' that controls the S_i. The emergence of the new system S' is a metasystem transition (MST). Turchin demonstrates that the emergence of learning, association and other key milestones in the evolution of adaptability in organisms can be usefully interpreted within this framework.

This framework suggests how the current psychological limitations of humanity might be overcome. Humans would need to develop a new psychological structure ('C' within the above framework) that is able to manage and control their internal reward and motivation system. The new structure would use mental modelling to identify the actions that would contribute best to the evolutionary success of humanity, and it would manage the pre-existing adaptive processes so they motivate and reward those actions.

We can draw on the work of Conant and Ashby (1970) to identify one of the key capacities that the new psychological structure must have if it is to manage the pre-existing adaptive processes effectively. Conant and Ashby demonstrated that if a regulator is to regulate a complex system effectively, it must include a model of the system. So the new psychological structure would have to develop models of the operation of the pre-existing adaptive processes themselves. To develop these models, the new structure would have to acquire knowledge about the pre-existing adaptive processes, how they operate, what effects they have on behaviour, and how their operation could be modified, influenced and managed. Emotional states, motivations and other elements of the pre-existing adaptive processes would have to become the objects of consciousness.

This suggests that the emergence of the new psychological structure would have to involve the turning of attention inwards—individuals would have to develop the capacity to direct their attention inside themselves and become aware of their mental, emotional and physical states. What evidence is there that humans can develop such an ability, and what might it lead to? We can begin to answer this question by examining the experiences of individuals who carry out the practice of introspective meditation. A significant part of this practice involves individuals directing their awareness and attention at their internal mental and other states. Meditators report

that they can enter a state in which there is a clear distinction between the flow of thought and feelings on the one hand, and the "I" that observes these on the other—the meditator is aware of herself as an observing "I" that is separate from her emotional states, thoughts and sensations—they arise and pass (see, for example, Deikman, 1996). This state contrasts with much of normal experience in which the "I' tends to be absorbed in emotional reactions and thoughts and is not aware of itself as separate to them.

Foreman (1998) provides evidence that extended meditation can, at least in some cases, produce this separation between the observing "I" and mental contents during normal life activities. The individual experiences the separation even when not meditating. In this state, thoughts, emotions and sensations as well as things in the external environment are experienced continually as objects of consciousness.

This emergence and strengthening of a self-aware, observing "I" is an important step toward the formation of the new psychological structure that is an essential part of the MST we are interested in. Because the new "I" is separate from mental contents, it can observe the pre-existing adaptive processes in action and accumulate the knowledge needed to model and understand their operation. However, this is only a first step. The observing "I" reported by introspective meditators is largely passive. It does not develop a comprehensive capacity to modify and manage the operation of the pre-existing adapting processes in the pursuit of evolutionary or other objectives. Techniques in addition to meditation are needed to develop a new "I" that has the will and power to do this.

A system of techniques that are specifically claimed to produce such a new "I" has been outlined by Nicol (1980a). Nicol was originally trained in this system by G. I. Gurdjieff and P. D. Ouspensky, but its historical origin is not clear (Moore, 1999). The practices have been taught in various forms in many countries since the 1920's by a number of groups, some organised internationally (Needham, 1995). However, the system has not been studied and tested systematically by academic psychologists, although a number of the specific practices and insights of the system are very similar to some that have been adopted and developed for use in clinical psychology, cognitive therapy and Neuro-Linguistic Programming (see, for example, Tart, 1986).

The techniques are explicitly directed at developing a new "I" that manages the pre-existing psychological processes of the individual in the service of whatever aims are adopted by the new "I" (Nicol, 1980b). The new "I" or master is produced by a number of practices that begin by functionally separating the individual's psychology into an observing part and an observed part (Nicol, 1980c). The observing part is the precursor of the new "I" or master. But initially it is a passive and non-judgemental witness of the observed part, broadly equivalent to the observing "I" that is developed through introspective meditation. From the outset, however, the observing "I" produced by Nicol's techniques is developed during the normal activities of life, rather than through a separate practice such as meditation.

The observed part includes the physical sensations, emotions, motivations, mental images and thoughts that arise as the individual goes about her daily activities and interactions—the observed part is the pre-existing adaptive processes in operation. A key objective of the system is to develop the ability of the observing "I" to stand outside and not be absorbed in the stream of mental contents that comprise the observed part. Separation between the precursor to the new "I" or master and the pre-existing adaptive processes is essential for the eventual development of a

master that is functionally independent of the pre-existing processes and that can therefore manage and modify them.

As the new "I" develops, the techniques utilised by the system enable the "I" to accumulate knowledge about the operation of the physical, emotional and mental adaptive processes, the effects they have on behaviour, and how their operation can be modified and influenced to bring their goals into line with the central aims of the new "I". This enables the "I" to develop mental models of the pre-existing processes and how they can be managed. The "I" develops these capacities in much the same way that the individual earlier developed the ability to manage her external environment—the individual first became aware of her external environment and of objects within it, then gradually accumulated knowledge about how the environment responded to her interventions, and used this to develop the capacity to manage external circumstances to achieve her adaptive goals. Now the individual turns her attention inwards and develops the capacity to manage and modify elements of her internal environment.

The new "I" or master that finally emerges is free of the adaptive goals of the pre-existing adaptive processes. It is able to modify these goals to align them with its own goals and objectives. The pre-existing processes no longer operate as constraints or restrictions on what the individual can decide to do. She can now find motivation and emotional satisfaction in whatever activities serve her central aim.

Key techniques and practices that are used by the system to develop the new "I" or master are self-observation, dis-identification, self-remembering, and divided attention.

Self-observation is the lynchpin of the system (Nicol, 1980c). It begins the functional separation of the individual's psychology into an observing part and an observed part. Self-observation requires the individual to turn her attention inwards and observe the physical sensations, emotional states and thoughts that arise during the normal activities and interactions of every-day life. This process has nothing in common with an individual cataloguing her personality attributes and traits. Instead it involves the individual standing outside and passively observing the actual sensations and states as they arise, in real time.

Self-observation must be passive and non-judgemental to develop full separation between the observing "I" and the operation of the pre-existing adaptive processes. Without this separation, the individual's "I" will be identified with the thoughts, emotional states and sensations that arise—it will be absorbed in and participate in them; it will not stand outside, observe and ultimately be able to manage them; the individual will continue to be her thoughts and emotional responses. Passive and non-judgemental self-observation helps to ensure that the observing "I" dis-identifies with mental contents.

At first an individual finds it difficult to maintain dis-identified self-observation for any length of time—she will tend to slip back into identification with thoughts or emotional states, and will fail to be able to stand outside or observe them for extended periods.

Self-remembering is an important technique for overcoming this difficulty. It strengthens the developing "I" or master, and renews its functional separation from the pre-existing adaptive processes. In self-remembering the individual simultaneously is aware that she is present and has the aim of developing a new "I" while also being aware of her physical, emotional and mental states. This act of self-remembering enables the individual to dis-identify and separate from the pre-existing processes, and to renew and strengthen self-observation. With practice an individual

can enter a state of self-remembering whenever she experiences a strong emotional state that would otherwise control her behaviour. This provides the individual with the opportunity to choose consciously how to act in response to the emotional state.

Divided attention is a practice related to self-remembering in which the individual remains aware that she is aware while observing physical, emotional and mental states and going about normal daily activities.

Self-remembering and divided attention are very important for developing the power of the new "I" to manage the pre-existing processes. Once the emerging new "I" can remain functionally separate from motivations and emotional impulses, and once it can remain aware that it is separate from them and can act independently of them, it can decide whether or not to be influenced by them. Instead of 'going with' these impulses as they arise, it can decide not to act on them. Importantly, this functional separation also enables the new "I" to control the disposition of attention. This enables the "I" to direct attention and energy only at activities that serve the aims of the "I". In these ways, the emerging new "I" can begin to consciously free the individual from control by the internal reward system.

But this form of management is limited to working with existing motivations and emotional impulses. To gain full control over its internal reward system, the new "I" must be able to develop motivations and emotional responses appropriate to its goals in circumstances that would not have previously evoked those responses. It must be able to find motivation and satisfaction in all the behaviours and actions needed to achieve its objectives.

The key techniques described by Nicol for the development of this capacity are based on the use of visualisation and the imagination. For example, if the individual wishes to develop new responses and motivations for particular circumstances and activities, the individual would imagine and visualise themselves in the circumstances in ways that evoke the desired responses. The system's approach is based on the view that individuals cannot control the operation of their emotional and motivational systems by thoughts or by self-talk alone. This view is consistent with the fact that the motivation and emotional system of humans evolved long before humans acquired a capability for language, and before our mental capacities were highly developed. So our emotional responses and motivations are not controlled and evoked by our thinking and by our self-talk. Rather they are evoked by the patterns we perceive in the circumstances we encounter (particularly patterns in social situations). For this reason, the new "I" must learn to communicate with the individual's motivation and emotional system primarily through images and imagined experiences rather than thoughts alone.

The use of visualisation and imagination in this way is consistent with the 're-scripting' techniques that are identified by Covey (1989) as a common element in many systems of personal development. It is also consistent with the conclusions reached by Cosmides and Tooby (2000) about the evolutionary function of imagined experience in re-weighting emotional responses to particular circumstances.

Through experimentation and self-observation, the emerging "I" builds up a repertoire of skills and techniques for managing the pre-existing adaptive processes. Many of the skills it develops have counterparts in therapeutic systems such as clinical psychology, psychotherapy, hypnotherapy, cognitive therapy and psychoanalysis. However, the essential difference is that in this system, the 'therapist' is the new "I" or master—the therapist is internalised as a new psychological structure within the individual.

It is worth emphasising here that the new "I" would not manage the pre-existing emotional and motivational systems by overriding and repressing them. The most effective way it can manage is by letting the pre-existing processes continue to solve the adaptive problems that they have evolved to handle, as far as possible. The new "I" is not in a position to take over their functions entirely. Instead the new "I" will do better if it limits its interventions to adjusting the goals of the pre-existing systems to align them with its own goals and aims. Just as the new "I" would continue to rely on the operation of the adaptive systems that control the individual's internal physiology, it would also continue to rely on the pre-existing motivation and emotional system. It takes them along with it in pursuit of new objectives. For example, it would continue to use the ability of the emotional system to quickly recognise significant patterns in social situations and in other circumstances. And it would integrate these abilities into the new metasystem for use in other cognitive functions.

In fact, an individual who has developed a new "I" will have more varied and diverse emotional responses than one who has not. This is because the existence of an "I" that can unite the pre-existing processes behind a central aim allows the pre-existing processes to differentiate and diversify where this is beneficial to the central aim—the processes can be more diverse without threatening the coherence of the individual's psychology. Such a differentiation and diversification of managed sub-systems is a characteristic of all MSTs (Turchin, 1977 and Stewart, 1997c)).

What evidence exists about the effectiveness of the system of techniques and practices outlined by Nicol? As indicated above, there are no systematic third person studies of the use of the practices and of their effects. However, there is an extensive and growing literature of first person reports (for an annotated bibliography see Driscoll, 1985 and 1999). In general, these reports suggest that the use of the practices for only a short period can provide an individual with some experience of what it would be like to develop a new "I" or master—it is relatively easy for an individual to get a "taste" of what it would be like to consciously manage her the pre-existing physical, emotional and mental processes. In particular, it is not difficult for the individual to achieve a state in which she experiences the "I" as standing outside the pre-existing processes, and is able to modify their impact on her behaviour when she chooses. However, to achieve the state on a more or less permanent basis is more difficult: very few report that they have been able to do so, and then only after persistent use of the practices over many years.

The literature does not include any reports of individuals using the system to pursue the goal of future evolutionary success. The original proponents of the system did not promote its use for evolutionary objectives in the sense used in this paper. However the system is obviously capable of being used to enable individuals to adopt and pursue evolutionary ends, or any other aim for that matter. It could be used to produce a psychological transformation that would enable individuals to implement whatever actions would contribute most to the future evolutionary success of humanity. Such a MST would overcome the psychological limitations that currently restrict our evolutionary adaptability. The system of techniques and practices would produce a new "I" or master that could manage the pre-existing physical, emotional and mental adaptive processes so that they will serve the evolutionary ends identified by the new "I". Assisted by mental modelling, the new "I" would use mental modelling to identify the actions that would contribute most to the future evolutionary success of humanity, and would manage the pre-existing processes to ensure that the individual found motivation and satisfaction in taking those actions. Pre-existing motivations, emotional responses, inculcated behaviours, beliefs and habits of thinking would no longer prevent the individual doing what is best in evolutionary terms. The

new "I" would be capable of revising any personality traits or behavioural predispositions that would otherwise stand in the way of achieving evolutionary objectives.

The new "I" would also use mental modelling of the individual's mental processes to search for ways to improve their operation. It would eliminate unproductive and negative habits of thinking, and use mental models of the modelling process itself to improve and adapt the modelling capacity (see, for example, Heylighen, 1991).

In general, the new "I" would be able to revise and recreate the individual's pre-existing adaptive processes continually through time to meet whatever evolutionary challenges may arise. Humans who successfully worked on themselves to undergo this metasystem transition would become self-evolving beings—organisms that are able to adapt in whatever ways are necessary for future evolutionary success, relatively unfettered by their biological past or by their previous life experiences (Stewart, 2000).

4. WILL HUMANITY OVERCOME ITS PSYCHOLOGICAL LIMITATIONS?

Will humans make the transition to become self-evolving beings? Will we develop the capacity to consciously modify our pre-existing adaptive processes so that we can take whatever actions are best for future evolutionary success?

The key impediment to making this transition it that it is not easy. In the present circumstances with current techniques and practices, significant personal effort, commitment and perseverance is necessary if an individual is to make the transition. For many, the prospect of being able to make a greater contribution to the evolutionary success of humanity is unlikely to provide sufficient motivation for the considerable investment required.

Nevertheless, increasing numbers of individuals are likely to develop the ability to manage their pre-existing adaptive processes, although not initially for evolutionary purposes. This is because the acquisition of this ability can provide immediate benefits to individuals. Individuals will be far more effective at achieving their key goals if they have the ability to align their pre-existing adaptive processes with those goals. They will be able to find satisfaction and motivation in all the actions needed to achieve their goals. In contrast, individuals who do not develop this psychological capacity are far less effective at pursing their goals. They are not able to implement actions that are not motivated and rewarded by their pre-existing processes, even though the actions may be essential for achieving their goals. They are not be able to revise personality traits or habits of thought that stand in the way of achieving their goals.

The advantages accruing to individuals who can manage their pre-existing processes will increase progressively as humans get better at using mental models to foresee the consequences of their actions. As knowledge accumulates, humans will increasingly see situations in which the actions motivated by their internal reward system are inconsistent with their goals. Increasingly their mental modelling will be superior to their pre-existing adaptive systems at identifying the best actions for achieving their goals.

The advantages of self-management will manifest most clearly where humans strongly compete with each other, such as in economic markets. Competition creates winners and losers. Individuals who can use self-management to achieve their competitive goals will have a significant competitive advantage. They will tend to out-compete those who are unable to do so.

And the gap will widen as knowledge accumulates and modelling improves. The incentives for the development of self-management will increase.

This is exactly what is occurring in market-based economies. Economic success is increasingly going to those who have some ability to self-manage. It is no accident there is a rapidly growing demand from business for personal development training and literature. Many corporations now train their executives in practices such as Neuro-Linguistic Programming, meditation, techniques designed to improve emotional intelligence and other self-development practices.

The spread of self-management skills is self-reinforcing. As well as the demonstration effect, the higher the proportion of individuals who are able to self-manage, the more those without the skills will be disadvantaged. Furthermore, as self-management spreads, individuals will increasingly encounter situations in which they will be called upon to behave as if they are self-managers. This effect can be expected to be particularly strong within families. Children brought up by self-managers will be continually subject to different demands and expectations to those who are not. Increasingly humans will grow up and operate in a social environment that demands and encourages a capacity for self-management. Eventually, a psychological transformation that once required enormous personal effort will occur routinely to many as they grow up amongst others who have already undergone the transformation.

Once an individual has undergone the psychological MST that enables self-management, it is a very small step to use self-management for evolutionary objectives. The individual will be able to adopt the aim of pursuing evolutionary success for humanity without having to be a psychological altruist. This is because she will be able to use the capacity for self-management to find psychological satisfaction and motivation in whatever it takes to pursue evolutionary success.

An individual will be more likely to adopt evolutionary objectives once she can mentally model (and therefore understand) the past psychological evolution of humanity, and the future possibilities. This understanding will tend to undermine the possibility that the individual could continue to find meaning in a life spent pursuing only the satisfactions provided by their pre-existing internal reward and motivation systems. The individual will see that these have no absolute validity or value. They are past evolution's best attempt to get us to behave in ways that will bring evolutionary success. But they are a flawed attempt that is inferior to what can be achieved when we supplement our adaptive ability with mental modelling. The individual will see that she does not have a choice about whether to pursue evolutionary objectives. The only choice is whether to do so guided by incompetent and outdated means, or to do so consciously, using the superior capacity of mental modelling. The individual will see that humans who continue to be guided only by their pre-existing reward and motivation systems are as absurd as a wind-up toy soldier that has run into a wall and fallen onto its back, but continues to march, on and on.

In summary, there are a number of factors and processes that can be expected to encourage the emergence of a new psychological MST amongst humans. But whether these influences will be sufficient to establish the transition widely amongst humanity is not yet clear.

5. CONCLUSION

Humanity is on the threshold of a major evolutionary transition.

Before the transition humans are organisms whose behavioural goals are set ultimately by their internal reward and motivation system. The internal rewards have been established and tuned by natural selection and conditioning processes. As a result, humans spend their lives pursuing proxies for evolutionary success. Humans have the capacity to use mental models to predict the effects of alternative actions on their environment. But they are largely limited to using this capacity to discover the actions that are best for achieving internal rewards. Humans do not use it for identifying and implementing adaptations that are best in evolutionary terms. Before the transition, humans are largely incapable of implementing behaviours that are inconsistent with their pre-existing reward and motivation system, even where their mental modelling reveals that the behaviours are far more adaptive in evolutionary terms. They are unable to use the much superior potential of mental modelling to discover the best adaptations.

If humans make the evolutionary transition, they will no longer blindly pursue internal rewards and motivations as ends in themselves. They will use their mental models to identify and implement the actions that will contribute most to the evolutionary success of humanity. By consciously managing their pre-existing adaptive systems, they will ensure that they find satisfaction and motivation in pursuing evolutionary objectives. They will no longer be incapable of using the superior adaptive capability of mental modelling to adapt their behavioural goals.

Humans are currently part way through the transition. As our ability to model the consequences of our behaviour improves, we are increasingly encountering situations in which our mental modelling is superior to our internal reward system at organising adaptive behaviour. We are beginning to develop the new psychological software needed for us to implement the behaviour identified by our mental models in these circumstances. But to develop a comprehensive ability to do this, humans will need to undergo a psychological MST. We will need to develop a new "I" or master that can manage our physical, emotional, and mental adaptive systems to align their goals with evolutionary objectives. This would enable us to revise the operation of these pre-existing processes so that we could adapt in whatever ways are needed for evolutionary success. Humans would become self-evolving beings, able to consciously choose to change our adaptive goals, relatively unfettered by our biological past or by our conditioning.

It is too early to say with certainty that humanity will negotiate this transition successfully. But it is clear that the unfolding of the transition will be given impetus as humans become aware of the nature of the transition, its significance in evolutionary terms, and their possible role in it.

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